What Is Claimed:

1. An apparatus for through-air drying webs comprising:

a cylindrical deck having sufficient open space to permit air flow therethrough;

a support structure positioned to support the cylindrical deck;

a support shaft concentrically positioned with respect to the cylindrical deck, the support structure being configured to rotate on the support shaft; and

at least one bearing positioned between the support shaft and the support structure to permit rotation of the support structure, the bearing being located so that there is substantially no moment transfer between the cylindrical deck and the support structure.

2. An apparatus as defined in claim 1, further comprising a hood surrounding the cylindrical deck for directing a hot gaseous stream through the cylindrical deck or away from the cylindrical deck.

3. An apparatus as defined in claim 1, further comprising a throughdrying fabric wrapped around the cylindrical deck, the throughdrying fabric being configured to carry a web over a portion of the surface of the deck.

4. An apparatus as defined in claim 3, wherein the throughdrying fabric is wrapped around the cylindrical deck from an upstream point to a downstream point leaving an open free end, and wherein the apparatus further comprises an external baffle positioned over the open free end of the cylindrical deck, the external baffle shielding the open free end of the drying cylinder from external air.

5. An apparatus as defined in claim 4, wherein the apparatus contains no internal baffles.

6. An apparatus as defined in claim 1, wherein the cylindrical deck comprises a plurality of individual deck plates that are attached to the support structure.

7. An apparatus as defined in claim 6, wherein the individual deck plates are attached to the support structure such that there is no moment present between the deck plates and the support structure and the deck plates are allowed to expand without imposing an additional load on the support structure.

8. An apparatus as defined in claim 6, wherein the individual deck plates are composed of hollow structural tubes.

9. An apparatus as defined in claim 6, wherein the surface of the individual deck plates are coated with a low-wear substance.

10. An apparatus as defined in claim 1, wherein the support structure comprises a first hub spaced from a second hub, each hub engaging an opposite end of the cylindrical deck, the apparatus including a first bearing and a second bearing, the first bearing being positioned between the first hub and the support shaft and the second bearing being positioned between the second hub and the support shaft, each bearing being substantially in alignment with each end of the cylindrical deck.

11. An apparatus as defined in claim 6, wherein the deck plates have a cross sectional profile that tapers in a direction opposite the direction of gas flow through the cylindrical deck.

12. An apparatus as defined in claim 10, wherein the support structure further comprises:

a rotating tube surrounding the support shaft, the rotating tube being connected at a first end to the first hub and at a second end to the second hub;

at least one internal deck support extending between the rotating tube and the cylindrical deck; and

a deck support ring supporting the cylindrical deck in between the first end of the cylindrical deck and the second end of the cylindrical deck, the support ring being connected to the at least one internal deck support.

13. An apparatus as defined in claim 12, wherein the support structure includes a first internal deck support and a second internal deck support extending between the rotating tube and the cylindrical deck, each of the deck supports being connected to the deck support ring.

14. An apparatus as defined in claim 6, wherein at least 80% of the surface of the cylindrical deck is open for allowing gas flow.

15. An apparatus as defined in claim 10, wherein the first hub and the second hub comprise assemblies made from multiple parts.

16. An apparatus as defined in claim 6, wherein a load supported by the deck plates of the cylindrical deck is the sum of the following forces:

$\omega = w \cdot t \cdot l \cdot \delta$ where:

ω = weight per unit length of a deck plate

w = width

t = thickness

l = unit length

δ = density of material

$F_p = 2 \cdot \Delta P \cdot r_o \cdot l \cdot \sin\left(\frac{\theta}{2}\right)$ where:

θ = Change in angle between deck plates

r_o = Outside radius of cylindrical deck

F_p = Force from differential pressure

l = Unit length of plate

$F_n = l \cdot t \cdot \delta \cdot \frac{V_i^2}{2 \cdot r_i^2}\left(r_o^2 - r_i^2\right)$ where:

F_n = Normal force on deck plate from rotation

t = thickness

l = unit length

δ = density of material

V_i = Velocity at "r_i"

r_i = radius on inside of deck plate

r = distance from center of the cylindrical deck; and

$F_t = 2 \cdot T \cdot \sin\left(\frac{\theta}{2}\right)$ where:

F_t = Force per unit length from tension

T = Fabric tension per unit length

θ = Change in angle between deck plates.

17. An apparatus as defined in claim 13, wherein the first deck support and the second deck support have a conical shape for directing gas flow between

the cylindrical deck and the first and second hubs and wherein the rotating tube shields the first bearing and the second bearing from the gas flow.

18. An apparatus as defined in claim 1, wherein the support shaft extends from one side of the cylindrical deck to a second and opposite side of the deck.

19. An apparatus for through-air drying webs comprising:

a rotatable cylindrical deck having sufficient open space to permit air flow therethrough, the rotatable cylindrical deck comprising a plurality of individual deck plates;

a support structure positioned to support the rotatable cylindrical deck, the support structure being attached to the individual deck plates; and

a support shaft concentrically positioned with respect to the rotatable cylindrical deck, the support structure being mounted on the support shaft.

20. An apparatus as defined in claim 19, wherein the individual deck plates are attached to the support structure using a pin attachment structure.

21. An apparatus as defined in claim 19, wherein the deck plates have a cross sectional profile that tapers in a direction opposite the direction of gas flow through the cylindrical deck.

22. An apparatus as defined in claim 19, wherein the support structure is configured to rotate on the support shaft and wherein the apparatus further comprises at least one bearing positioned between the support shaft and the support structure to permit rotation of the support structure, the bearing being located so that there is substantially no moment transfer between the cylindrical deck and the support structure.

23. An apparatus as defined in claim 19, further comprising a hood surrounding the cylindrical deck for directing a hot gaseous stream through the cylindrical deck or away from the cylindrical deck.

24. An apparatus as defined in claim 19, further comprising a throughdrying fabric wrapped around the cylindrical deck, the throughdrying fabric being configured to carry a web over a portion of the surface of the deck.

25. An apparatus as defined in claim 24, wherein the throughdrying fabric is wrapped around the cylindrical deck from an upstream point to a downstream point leaving an open free end, and wherein the apparatus further

comprises an external baffle positioned over the open free end of the cylindrical deck, the external baffle shielding the open free end of the drying cylinder from external air.

26. An apparatus as defined in claim 22, wherein the support structure comprises a first hub spaced from a second hub, each hub engaging an opposite end of the cylindrical deck, the apparatus including a first bearing and a second bearing, the first bearing being positioned between the first hub and the support shaft and the second bearing being positioned between the second hub and the support shaft, each bearing being substantially in alignment with each end of the cylindrical deck.

27. An apparatus as defined in claim 26, wherein the support structure further comprises:

a rotating tube surrounding the support shaft, the rotating tube being connected at a first end to the first hub and at a second end to the second hub;

at least one internal deck support extending between the rotating tube and the cylindrical deck; and

a deck support ring supporting the cylindrical deck in between the first end of the cylindrical deck and the second end of the cylindrical deck, the support ring being connected to the at least one internal deck support.

28. An apparatus as defined in claim 27, wherein the support structure includes a first internal deck support and a second internal deck support extending between the rotating tube and the cylindrical deck, each of the deck supports being connected to the deck support ring.

29. An apparatus as defined in claim 19, wherein at least 80% of the surface of the cylindrical deck is open for allowing gas flow.

30. An apparatus as defined in claim 28, wherein the first deck support and the second deck support have a useful shape for directing gas flow between the cylindrical deck and the first and second hubs and wherein the rotating tube shields the first bearing and the second bearing from the gas flow.

31. An apparatus for through-air drying webs comprising:

a cylindrical deck having sufficient open space to permit air flow therethrough;

a stationary support shaft concentrically positioned with respect to the cylindrical deck; and

a support structure positioned between the cylindrical deck and the support shaft for supporting the cylindrical deck, the support structure being configured to rotate on the support shaft, the support structure comprising a first hub spaced from a second hub, each hub engaging an opposite end of the cylindrical deck, the support structure further comprising a rotating tube surrounding the support shaft, the rotating tube being connected at a first end to the first hub and at a second end to the second hub.

32. An apparatus as defined in claim 31, wherein the support structure further comprises at least one internal deck support extending between the rotating tube and the cylindrical deck, and a deck support ring supporting the cylindrical deck in between the first end of the cylindrical deck and the second end of the cylindrical deck, the support ring being connected to the at least one internal deck support.

33. An apparatus as defined in claim 32, wherein the support structure includes a first internal deck support and a second internal deck support extending between the rotating tube and the cylindrical deck, each of the deck supports being connected to the deck support ring.

34. An apparatus as defined in claim 31, wherein the apparatus further comprises a first bearing and a second bearing, the first bearing being positioned between the first hub and the support shaft and the second bearing being positioned between the second hub and the support shaft, each bearing being substantially in alignment with each end of the cylindrical deck.

35. An apparatus as defined in claim 34, wherein the first and second bearings are located so that there is substantially no moment transfer between the cylindrical deck and the support structure.

36. An apparatus as defined in claim 31, further comprising a hood surrounding the cylindrical deck for directing a hot gaseous stream through the cylindrical deck or away from the cylindrical deck.

37. An apparatus as defined in claim 31, further comprising a throughdrying fabric wrapped around the cylindrical deck, the throughdrying fabric being configured to carry a web over a portion of the surface of the deck.

38. An apparatus as defined in claim 37, wherein the throughdrying fabric is wrapped around the cylindrical deck from an upstream point to a downstream point leaving an open free end, and wherein the apparatus further comprises an external baffle positioned over the open free end of the cylindrical deck, the external baffle shielding the open free end of the drying cylinder from external air.

39. An apparatus as defined in claim 31, wherein the cylindrical deck comprises a plurality of individual deck plates that are attached to the support structure.

40. An apparatus as defined in claim 39, wherein the individual deck plates are attached to the support structure using a pin attachment structure.

41. An apparatus as defined in claim 39, wherein the deck plates have a cross sectional profile that tapers in a direction opposite the direction of gas flow through the cylindrical deck.

42. An apparatus as defined in claim 39, wherein a load supported by the deck plates of the cylindrical deck is the sum of the following forces:

$\omega = w \cdot t \cdot l \cdot \delta$ where:

ω = weight per unit length of a deck plate

w = width

t = thickness

l = unit length

δ = density of material

$F_p = 2 \cdot \Delta P \cdot r_o \cdot l \cdot \sin\left(\frac{\theta}{2}\right)$ where:

θ = Change in angle between deck plates

r_o = Outside radius of cylindrical deck

F_p = Force from differential pressure

l = Unit length of plate

$F_n = l \cdot t \cdot \delta \cdot \frac{V_i^2}{2 \cdot r_i^2}\left(r_o^2 - r_i^2\right)$ where:

F_n = Normal force on bar from rotation

t = thickness
l = unit length
δ = density of material
V_i = Velocity at "r_i"
r_i = radius on inside of support bar
r = distance from center of TAD; and

$$F_t = 2 \cdot T \cdot \sin\left(\frac{\theta}{2}\right)$$

where: F_t = Force per unit length from tension
T = Fabric tension per unit length
θ = Change in angle between deck plates.

43. An apparatus as defined in claim 33, wherein the first deck support and the second deck support have a conical shape for directing gas flow between the cylindrical deck and the first and second hubs and wherein the rotating tube shields the first bearing and the second bearing from the gas flow.

44. An apparatus for through-air drying webs comprising:

a cylindrical deck having sufficient open space to permit air flow therethrough, the cylindrical deck having a diameter;

a support structure positioned to support the cylindrical deck, the support structure further being configured to rotate the cylindrical deck; and

wherein the cylindrical deck and the support structure are configured to be disassembled, the apparatus having a disassembled volume when being shipped, the disassembled volume having a maximum dimension that is less than one half the diameter of the cylindrical deck.

45. An apparatus as defined in claim 44, wherein the cylindrical deck comprises a plurality of individual deck plates that are attached to the support structure.

46. An apparatus as defined in claim 45, wherein the support structure comprises a first hub spaced from a second hub, each hub engaging an opposite end of the cylindrical deck, the support structure further comprising at least one internal deck support and a deck support ring that provides support to the cylindrical deck in between the first end of the cylindrical deck and the second end of the cylindrical deck.

47. An apparatus for through-air drying webs comprising:

a cylindrical deck having sufficient open space to permit air flow therethrough;

a support structure positioned to support the cylindrical deck, the support structure comprising a first hub spaced from a second hub, each hub engaging an opposite end of the cylindrical deck;

a support shaft concentrically positioned with respect to the cylindrical deck, the support structure being configured to rotate on the support shaft; and

a first bearing positioned between the first hub and the support shaft and a second bearing positioned between the second hub and the support shaft, each bearing being substantially in alignment with each end of the cylindrical deck.